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Jack Pine Ingress Following Aerial Seeding

by

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An early and accurate judgement of regeneration success through the application of stocking standards is essential when assessing reforestation efforts. To be reliable, standards must incorporate a knowledge of post regeneration stand development and compositional trends.

In Ontario, stand dynamics information is needed to supplement or confirm official regeneration standards. This note describes changes in stocking and density, 17 years after treatment, in a young jack pine (*Pinus banksiana* Lamb.) stand.

The stand, established by aerial seeding, is located on a fine to medium textured sand plain in the Nipigon Site District of Site Region 3W (Hills 1960). The area originally supported a jack pine stand which had been repeatedly burned (1949, 1955 and 1956) leaving exposed mineral soil. Ground vegetation at time of seeding was small and sparse. There were no residual trees to supplement the jack pine seed sown in June of 1957. The early regenerative phases up to 1963 were reported by Kokocinski (1965).

The area was resurveyed in 1974. A total of 154 mil-acre (4.05 m^2) quadrats systematically arranged throughout the area were destructively sampled. On each quadrat, the number of jack pine and associated pioneer species was recorded. In addition, heights, diameters, suppression status and total stem age information were collected for all species. Stocking and density patterns were analyzed using stem age information from stems alive in 1974. This report is an analysis of the jack pine component.

Results and Discussion

In the 11 years between surveys, the jack pine has maintained a stable density around 4700 stems per hectare (Table 1) while stocking has increased 10%. Black spruce (*Picea mariana* (Mill.) B.S.P.) has increased in both density and stocking while poplar (*Populus tremuloides* Michx.) has shown a sizable reduction in density and stocking. Jack pine has attained the numerical dominance predicted by Kokocinski (1965).

While the jack pine density appears to be reasonably constant, the year of origin/frequency information in Fig. 1 demonstrates a more dynamic situation. There have been two distinct periods of jack pine ingress contributing to the 1974 density. The first, as reported by Kokocinski (1965),

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TABLE 1 Status of stocking and density in 1963 and 1974

Year of survey		Jack pine	Black spruce	Trembling aspen	All species
1963	% stocking	56	10	83	94
	stems/ha (acres)	4665 (1888)	319 (129)	10470 (4237)	15454 (6254)
1974	% stocking	66	28	26	86
	stems/ha (acres)	4599 (1861)	1030 (417)	1147 (464)	7220 (2922)

involved seedlings established by the original aerial seeding and from seed from cones on the 4- to 7-year-old stems. This surge, combining the two seed sources, lasted at a declining rate for nine years after the original sowing. The second surge started 12 years after sowing and was continuing irregularly at the time of the re-survey. Both of these ingresses were associated with real increases in the jack pine percent stocking.

Although the study method used, i.e. stem analysis of living stems, did not contribute definite information on mortality, it is expected that mortality occurred through competition for light, moisture and nutrients. Mortality is, in this case, considered of lesser importance in relation to the process of ingress. The fact that ingress actually occurred in of management value regardless of whether the new seedlings are replacements or supplements. The 10% increase in stocking as indicated by the year of origin/ stocking relationship in Fig. 1 is firm evidence that previously unstocked areas are slowly filling in.

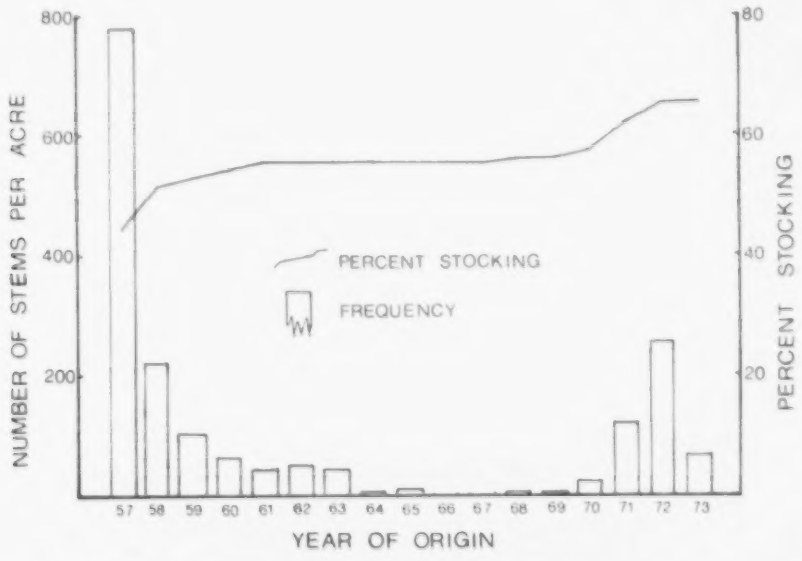

FIG. 1 Density and cumulative percent stocking by year of origin for jack pine alive in 1974.

Logically, successful seedling establishment is related to a combination of adequate seed supply and adequate seedbed. Kokocinski (1965) reported that the early ingress was associated with a seed supply from the treatment and the juvenile jack pine which were growing on seedbeds of mineral soil and moss patches. The second ingress is the result of a seed supply from those jack pine stems which declared dominance as partial crown closure took place in the denser bands of trees in the developing stand. Those stems growing above competition averaged 7.9 m (25.8 feet) in height and 68% of these stems were producing cones in 1974. In comparison, the suppressed stems were significantly shorter (at the 99% level) averaging 5.4 m (17.8 feet) in height and only 33% bore cones. The new seedlings were present on needle litter seedbeds, on moss(hylocomium and sphagnum) and on small patches of mineral soil that remained. The variety of seedbeds suggests that stand development and partial crown closure had modified light, temperature and moisture extremes in the internal stand openings to make them amenable to germination and survival. As far as the continued survival and development of the seedlings is concerned the future is uncertain. These are late starting small seedlings that are intolerant to shade occurring in unstocked openings in an established stand. Their presence is encouraging but their potential to develop into crop trees will depend on the size of the opening and the rate at which crown closure from the sides takes place. Speculation suggests that if the opening is large, crop trees could develop. This aspect requires further study.

A knowledge of species' growth rates, as well as percent stocking and stand density conditions, are essential ingredients in complete stocking standards. Growth rates for any species will vary according to the site potential, stand density and competition interactions. In this area, for the particular circumstances, the height growth is presented in Fig. 2. The average height of 7.5 m (24.5 feet) at age 17 years represents a height growth rate of 0.43 m (1.4 feet) per year which is equal to that of 20-year-old Site Class I jack pine (Plonski 1971). Acceptable height development is, therefore, present in this stand.

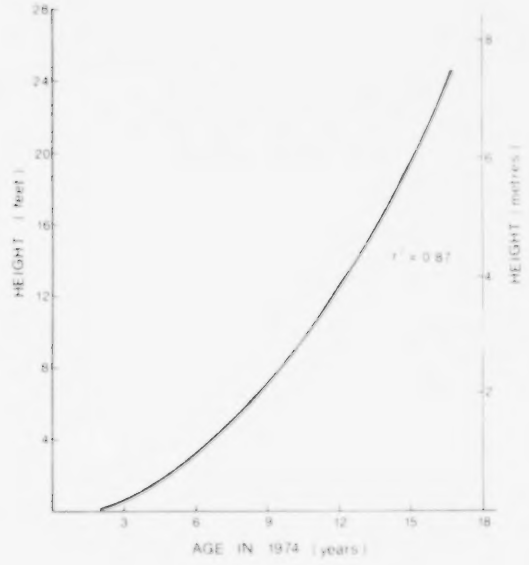

FIG. 2 Height-age relationship.

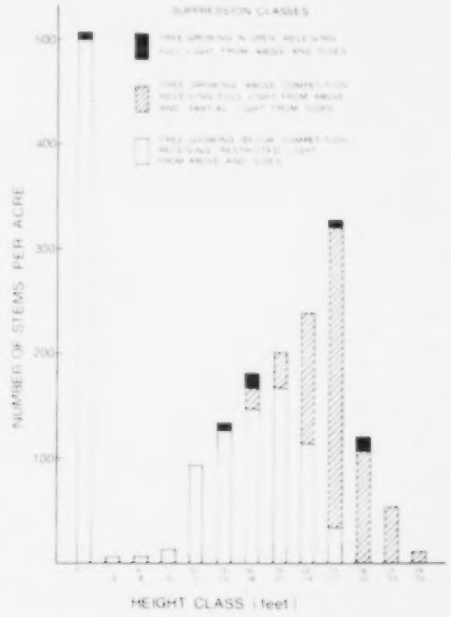

FIG. 3 Suppression-height class distribution in 1974.

The number of stems that are free to develop into crop trees, although continuously changing in an immature stand, is a useful indicator of future potential when judged over the rotation period. Fig. 3 presents the frequency distribution of the stems living in 1974 classified by suppression classes. Excluding the small seedlings from the latest ingress, there are 1636 stems per hectare (662/acre) over 4 m in height that, at stand age 17, had the potential to develop into crop trees, i.e. all those above competition or in the open. Although this number is far less than the 5580 stems per hectare (2558/acre) suggested by Plonski (1971) for 20-year Site Class I jack pine, it is close to double the number he suggests for 70-year jack pine. At this early age, these data indicate only a potential for an acceptable future stand density. Predictions for the next 50+ years can only be based on further data collection. Additional data would verify the current possibility that rates of mortality related to competition would be lower in less dense stands such as this.

The current Ontario stocking standards (Robinson 1978) specify that at the end of a regeneration period of 5 years after treatment, desirable distribution of jack pine should be at least 60% mil-acre stocking. For this particular stand and silvicultural treatment, jack pine ingress has increased stocking to a level above the minimum desirable in a stand that is developing at an acceptable rate of growth with a speculatively acceptable number of potential crop trees. Ingress, as well as its duration, is a process that should be included in stocking standard determinations. If jack pine ingress is a common occurrence and wherever a prolonged regeneration period such as this is acceptable, the data suggest that the minimum standard may not have to be as high as 60%. Further study in other jack pine situations is recommended.

Acknowledgement

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